Results: The frequencies of which the small, medium and large size plans were used over the (total of 600) fractions were similar; plans were used at a median of 9, 9.5 and 10 fractions respectively. The median volume ratio of PTV-ART vs. non-ART across the treatment course was 0.70 (range: 0.46-0.89). The median rectal volume receiving 50 Gy or more was 5% (range: 0-41%), compared to 17% (range: 0-62%) if the patients had been treated with standard, non-adaptive RT (Fig 1). For the bowel cavity, the median volume receiving more than 45 Gy was 392 cm^3 (range: 84-625 cm^3), compared to 487 cm^3 (range: 126-710 cm^3) if not treated with adaptation (Fig 1).

Conclusions: Daily adaptive plan selection in RT of bladder cancer results in a considerable normal tissue sparing, which is expected to reduce the risk of gastro-intestinal morbidity.

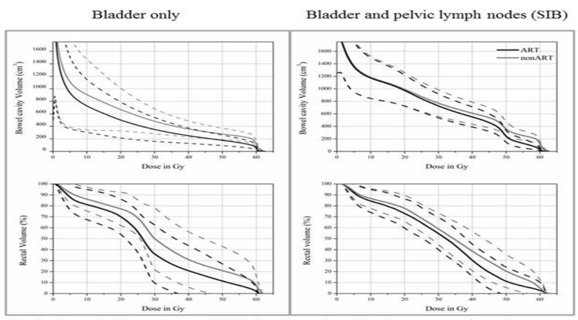

Fig 1: Population-average DVHs for bowel cavity (upper part) and rectum (lower part) for patients treated with RT to the bladder only (left) as well as patients where both the bladder and the pelvic lymph nodes were treated (right). The dotted lines represent one standard deviation and all curves are based on planning CT data.

Joint Symposium: ESTRO-EFOMP-AAPM: How to invigorate medical physics research in a clinical environment

SP-0108

Interdisciplinary medical physics research: Connections with academic and commercial partners

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Medical physicists contribute to maintaining and improving quality, safety and cost-effectiveness of healthcare services through patient-oriented activities requiring expert action, involvement or advice regarding the specification, selection, acceptance testing, commissioning, quality assurance/control and optimised clinical use of medical radiological devices. Medical physicists working in a clinical environment are healthcare professionals and those at the highest level (level 8 on the European qualifications framework)are Medical Physics Experts(MPEs) competent to practice independently in one or more of the subfields (specialties) of medical physics; in this way the MPE has the capabilities to tackle clinical problems through strategic multidisciplinary approaches.

Today the multidisciplinary approach with medical physicists in the clinical environment together with those in the commercial industry as well as university research areas is mandatory where dosimetry, dosimetric calculation and medical imaging for planning and verification needs to be approached with a number of different competences. Collaboration on clinical research projects between commercial partners and medical physicists/MPE should therefore be encouraged at all levels.

Academic partners have the capabilities to develop new applications of physics in medicine (linear accelerators, new detectors, Monte Carlo simulations, etc.) and have the competences required to support such developments. The experience derived from protosyncrotony and ion and particle accelerator developments in particle research has provided fundamental experience to understand what the correct approach needs to be to tackle the clinical applications.

Companies have the role to develop hardware and software devices for radiotherapy but need medical physics competences for testing and optimization "on the field". Many advanced medical physics departments are "beta-site" for different applications. Pre-release software for treatment planning, new treatment modalities, image processing and registration technique for Adaptive planning , integrated MRI/linear accelerator and high intensity focused ultrasound (HIFU) in oncology therapy are typical examples where a multidisciplinary approach is essential. A PACS solution for radiotherapy is another examples where medical physicists are able to define the functional differences between the PACS required for radiotherapy compared with the requirements for conventional radiology PACS.

New software for image integration and registration techniques must first be validated in clinical practice and the multidisciplinary medical physics department is an essential partner for companies to create optimized protocols for clinical use.

Finally the medical physicist/MPE is frequently involved in training activities and these experts can also be used to inform companies on their development profiles.

The use of webinar will provide further opportunities for the cooperation and training for all the actors involved in radiotherapy.

In conclusion, in order to ensure that the quality of patient treatments is maintained and further improved while the risk of errors is reduced it is necessary that all these activities are to be carried out in the clinical working environment. In addition many of these activities require further development and improvement within a research environment parallel to the clinical work.

However, staff often have to carry out research and development outside normal working hours due to lack of time. This situation is not sustainable and could finally result in unsafe patient treatments. It must be realized that medical physics departments should have at least an additional 0.3 whole time equivalent staffing complement (ref. European Guidelines on Medical Physics Expert (Annex 2)) to carry out these important research and development activities.

References: European Guidelines on Medical Physics Expert, Annex 2, Radiation Report No174, European Commission, 2014

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Trends in clinical and academic medical physics research in the US

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In the past decade the introduction of new technologies such as IMRT has given a strong boost to medical physics and the field of radiation oncology in the US. In the period from 2003 until 2009 alone, the expenditure for radiation oncology has